REMARKS

In accordance with the foregoing, claims 15 and 29 have been amended. Claims 1-36 are pending.

Initially applicant wishes to thank the Examiner for indicating that claims 9 and 10 are allowed and that claims 14, 16, 22, 28, 30 and 31 contain allowable subject matter.

No new matter is believed to have been added.

I. OBJECTION TO CLAIMS 15 AND 29 BECAUSE OF INFORMALITIES.

Claims 15 and 29 have been amended taking the Examiner's comments into consideration.

In view of the above, it is respectfully submitted that the objection to claims 15 and 29 is overcome.

II. REJECTION OF CLAIMS 1-2 AND 6-7 UNDER 35 USC 103(a) AS BEING UNPATENTABLE OVER TAKAGI ET AL. (5,999,691, "TAKAGI") IN VIEW OF KURODA (6,331,011, "KURODA").

Applicant respectfully traverses this rejection.

Kuroda has an effective filing date of December 13, 1999.

The present invention has an effective filing date of July 28, 1999, based on the perfected claim for priority filed with the application on July 28, 2000. Please see the enclosed verified English language translation of the previously submitted priority document, Korean Application No. 99-30938.

The Action admits that Takagi does not disclose every limitation of claims 1, 2, 6 and 7 and relies on Kuroda as disclosing the missing limitations. Because Kuroda is not prior art, it is respectfully submitted that the rejection of claims 1, 2, 6 and 7 is overcome.

III. REJECTION OF CLAIMS 3-5 AND 8 UNDER 35 USC 103 AS BEING UNPATENTABLE OVER TAKAGI ET AL. (5,999,691, "TAKAGI") IN VIEW OF KURODA (6,331,011, "KURODA") AND KIKUCHI ET AL. (5,870,523, "KIKUCHI").

Applicant respectfully traverses this rejection.

Kuroda has an effective filing date of December 13, 1999.

The present invention has an effective filing date of July 28, 1999, based on the perfected claim for priority filed with the application on July 28, 2000. Please see the enclosed verified English language translation of the previously submitted priority document, Korean Application No. 99-30938.

Claims 3-5, and 8 all depend, either directly or indirectly from independent claim 1. Therefore, because Kuroda does not qualify as prior art and Takagi does not teach all the limitations of claim 1, it is respectfully submitted that the rejection of claims 3-5 and 8 is overcome.

IV. REJECTION OF CLAIMS 11-12, 18-20, 24-26 AND 32-36 UNDER 35 USC 103 AS BEING UNPATENTABLE OVER YONEDA (6,002,832, "YONEDA") IN VIEW OF KURODA (6,331,011, "KURODA").

Applicant respectfully traverses this rejection.

Kuroda has an effective filing date of December 13, 1999.

The present invention has an effective filing date of July 28, 1999, based on the perfected claim for priority filed with the application on July 28, 2000. Please see the enclosed verified English language translation of the previously submitted priority document, Korean Application No. 99-30938.

The Action admits that Yoneda does not disclose every limitation of independent claims 11, 19 and 25 and relies on Kuroda as disclosing the missing limitations. Because Kuroda is not prior art, it is respectfully submitted that the rejection of claims 11-12, 18-20, 24-26 and 32-36 is overcome.

V. REJECTION OF CLAIMS 13, 17, 21 AND 27 UNDER 35 USC 103 AS BEING UNPATENTABLE OVER YONEDA (6,002,832, "YONEDA") IN VIEW OF KURODA (6,331,011, "KURODA") AND KIKUCHI ET AL. (5,870,523, "KIKUCHI").

Applicant respectfully traverses this rejection.

Kuroda has an effective filing date of December 13, 1999.

The present invention has an effective filing date of July 28, 1999 based on the perfected claim for priority filed with the application on July 28, 2000. Please see the enclosed verified English language translation of the previously submitted priority document, Korean Application No. 99-30938.

Claims 13 and 17 depend, either directly or indirectly from independent claim 11. Claim 21 depends from claim 19. Claim 27 depends from claim 25. Therefore, because Kuroda does not qualify as prior art and Yoneda does not teach all the limitations of claim 11, 19 and 27, it is respectfully submitted that the rejection of claims 13, 17, 21, and 27 is overcome.

VI. CONCLUSION.

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: August 27, 2004

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CERTIFICATION FOR TRANSLATION

As a below named translator, I hereby declare that:

My residence and citizenship are as stated below next to my name.

I hereby certify that I am conversant with both the English and Korean languages and the document enclosed herewith is a true English translation of the priority document with respect to the Korean Patent Application No. **30938/1999** filed on **28 July 1999.**

NAME OF THE TRANSLATOR : Ji-Eun YUN

SIGNATURE : Jieun Yun **Date** : 24 August 2004

RESIDENCE : MIHWA BLDG., 110-2, MYONGRYUN-DONG 4-GA, CHONGRO-GU, SEOUL 110-524, KOREA

CITIZENSHIP : REPUBLIC OF KOREA

Translation of Priority Document

THE KOREAN INTELLECTUAL PROPERTY OFFICE

This is to certify that annexed hereto is a true copy from the records of the Korean Industrial property Office of the following application as filed

Application Number	:	Patent Application No. 30938/1999
Date of Application	:	July 28, 1999
Applicant(s)	:	Samsung Electronics Co., Ltd.

COMMISSIONER

[ABSTRACT OF THE DISCLOSUSRE]

[ABSTRACT]

A method of arranging divided recording area segments of a recording medium in a broadcast receiving system having a random access storage device. In the method, a circular buffer area is disposed in a first predetermined position of the recording medium, for recording a first broadcast signal in real time while reproducing a previously recorded first broadcast signal, a video file area is disposed in a second predetermined position of the recording medium, for recording a second broadcast signal in a logical file at a predetermined time, and a control information area is disposed in a third predetermined position of the recording medium, for recording information about recorded files.

[REPRESENTATIVE FIGURE]

FIGURE 5

[INDEX]

Time-delayed watching, Circular buffer, Hard disk

[SPECIFICATION]

[TITLE OF THE INVENTION]

METHOD OF ARRANGING DIVIDED RECORDING AREA SEGMENTS OF RECORDING MEDIUM IN BROADCAST RECEIVING SYSTEM

[BRIEF DESCRIPTION OF THE DRAWINGS]

FIG. 1 illustrates a hard disk managed as a circular buffer in a broadcast receiving system for time-delayed watching;

FIG. 2 illustrates a hard disk managed to arrange a plurality of video streams uncontinuously;

FIG. 3 is an exemplary I/O transaction scheduling diagram of an HDD for recording and reproducing a plurality of video streams in real time;

FIG. 4 is a block diagram of a broadcast receiving system which can support time-delayed watching and recording/reproduction of a broadcast program according to an embodiment of the present invention;

FIG. 5 illustrates arrangement of hard disk recording area segments according to the embodiment of the present invention;

FIG. 6 illustrates video streams recorded in hard disk recording area segments according to the embodiment of the present invention;

FIG. 7 illustrates a procedure of processing streams assigned as shown in FIG. 6 in a C-LOOK algorithm; and

FIG. 8 is a simplified view of a hard disk recording area according to the embodiment of the present invention.

[DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT]

[OBJECT OF THE INVENTION]

[RELATED FIELD AND PRIOR ART OF THE INVENTION]

The present invention relates generally to a broadcast receiving system which can simultaneously support time-delayed watching of a broadcast program and recording/reproduction of the program, and in particular, to a method of arranging divided recording area segments in a recording medium to allow time-delayed watching of a broadcast program, while the program is being recorded/reproduced.

A hard disk drive (HDD) in a computer system is randomly accessible. Due to its advantages of low cost and large capacity relative to other auxiliary memories and a high data transmission rate, the HDD is used as a random access storage device for a broadcast receiving system.

A broadcast receiving system with a random access storage device enables simultaneous recording/reproduction and time-delayed broadcasting of video streams. This can be achieved by controlling buffering of video streams input/output to/from an HDD.

There will be given a description of a method of arranging video streams on a hard disk surface as a recording medium in a broadcast receiving system which supports simultaneous time-delayed watching and recording/reproduction of the video streams.

FIG. 1 illustrates a hard disk managed as a circular buffer in a broadcast receiving system for time-delayed watching, and FIG. 2 illustrates a hard disk managed to arrange a plurality of video streams uncontinuously.

In the case of a hard disk managed as a circular buffer, video streams are recorded in blocks of a fixed size as shown in FIG. 1. A write point W and a read point R are set on a hard disk surface. New video streams are recorded, moving a head clockwise from the write point, and predetermined video streams are played back by randomly accessing the circular buffer at a specific time.

On the other hand, to uncontinuously arrange video streams on a hard disk drive as shown in FIG. 2, a hard disk surface is divided into blocks of a fixed size and video streams are recorded in video files, each including a plurality of blocks. In this case, the blocks are always not successively arranged because deletion of video files of different sizes result uncontinuous free blocks. Information about each video file (title, time information, and so on) and information about the positions of blocks in each video file is recorded in a control information area.

FIG. 3 is an exemplary I/O transaction scheduling diagram for an HDD on/from which video streams are recorded/reproduced in real time. In 송 drawing, three video streams are processed using a C-LOOK algorithm by way of example. The C-LOOK algorithm is similar to a SCAN-Earliest-Deadline-First (SCAN-EDF) scheme disclosed in "I/O Issues in a Multimedia System", Reddy A.L.N. and Wyllie J.C., IEEE Computer Vol. 27. No. 3, March 1994, pp. 67-74, "Multimedia File Systems Survey:

Approaches for Continuous Media Disk Scheduling", Ralf Steinmetz, Computer Communications, Vol. 18, No. 3, March 1995, pp. 133-144, and a gated operation disclosed in U.S. Patent No. 5,754,882. Hence, its description is omitted herein.

Referring to FIG. 3, video streams #1 and #2 are being played back and video stream #3 is being recorded. In most video stream processing methods, an HDD I/O control is implemented at every predetermined period T and video streams are processed in each period. For example, if video streams #1 and #2 are read from corresponding blocks on a hard disk surface in period T_{i-1}, they are played back in period T_i (this corresponds to consumption from a video processor's viewpoint). For continuous reproduction without interruption, blocks to be played back in the next period should be read from the HDD in the current period. For recording, blocks should be generated in the current period and then transmitted to the HDD in the next period. The order of processing video streams in a period depends on an I/O transaction scheduling scheme. In the C-LOOK algorithm, the order of processing video streams corresponds to a head moving direction. Assuming that a head of the HDD is moving from an outermost circumferential track to an innermost circumferential track and video stream blocks #1, 2, and 3 are located in tracks #10, 100, and 60, respectively, the video streams #1, 3, and 2 are read in this order in T_i as shown in FIG. 3.

A broadcast receiving system which manages a hard disk area as a circular buffer as shown in FIG. 1 can reproduce a previously recorded video stream with a time delay while recording a video stream. However, it cannot record and reproduce a plurality of video streams at the same time. In addition, video streams cannot be formed in video file units and an arbitrary video file cannot be deleted.

On the other hand, a broadcast receiving system which arranges video streams uncontinuously as shown in FIG. 2 can store recorded video streams in video files since it can utilize hard disk space freely. But buffer management for time-delayed watching is not easy because blocks are not automatically reused in a limited area as compared to a circular buffer. This is because free blocks are scattered.

[SUBSTANTIAL MATTER OF THE INVENTION]

It is, therefore, an object of the present invention to provide a method of overcoming conventional problems encountered in using a recording area of a recording

medium in a broadcast receiving system which can support time-delayed watching and recording/reproduction of a broadcast program at the same time.

It is another object of the present invention to provide a method of efficiently managing divided recording area segments of a recording medium to simultaneously provide time-delayed watching and recording/reproduction of a plurality of video streams in a broadcast receiving system.

It is a further object of the present invention to provide a method of managing divided recording area segments of a recording medium to simultaneously provide time-delayed watching and high speed recording/reproduction of a plurality of video streams in a broadcast receiving system.

These and other objects of the present invention can be achieved by providing a method of arranging divided recording area segments of a recording medium in a broadcast receiving system having a random access storage device. In the method, a circular buffer area is disposed in a first predetermined position of the recording medium, for recording a first broadcast signal in real time while reproducing a previously recorded first broadcast signal, a video file area is disposed in a second predetermined position of the recording medium, for recording a second broadcast signal in a logical file at a predetermined time, and a control information area is disposed in a third predetermined position of the recording medium, for recording information about recorded files.

[CONSTRUCTION AND OPERATION OF THE INVENTION]

A preferred embodiment of the present invention will be described hereinbelow with reference to the accompanying drawings. In the following description, well-known functions or constructions are not described in detail since they would obscure the invention in unnecessary detail.

FIG. 4 is a block diagram of a broadcast receiving system capable of broadcasting a program with a time delay and recording/reproducing the program simultaneously.

Referring to FIG. 4, a broadcast signal receiver 10 includes an RF (Radio Frequency) tuner 12 for receiving an external digital broadcast signal, RF tuners 14 and 16 for receiving an external analog broadcast signal, and video compressors for

converting analog signals received from the RF tuners 14 and 16 to digital signals and compressing the digital signals.

A random access storage device 30 records digital video streams received from the broadcast signal receiver 10 on a hard disk surface, reads the stored video streams, and outputs the read video streams to a recovery unit 50 under the control of a controller 50. As well known, the random access storage device 30 is comprised of a dual port RAM 32 for temporarily storing the digital video streams, a hard disk (hard disks) for permanently storing the digital video streams, an HDD controller for controlling the HDD to be driven, and an expander for expanding the HDD. The expander is an IEEE 1394 interface.

The video recovery unit 50 recovers a video stream received from the random access storage device 30 through a system bus to an original signal and outputs the recovered signal to a TV receiver 90.

The controller 40 includes a ROM for storing control program a\data to control the random access storage device 30 and the broadcast signal receiver 10 and a RAM for temporarily storing data generated during a control operation.

A remote controller 60 has a plurality of adjustment keys for system control, generates data corresponding to a key input, and feeds the data to the controller 40. The adjustment keys are "pause", "rewind", "rapid search", and so on.

A computer interface 70 interfaces a transmitted/received signal between the broadcast receiving system of the embodiment of the present invention and a computer. A timer 80 generates time information so that the broadcast receiving system can record a program automatically.

FIG. 5 illustrates a hard disk recording area according to the embodiment of the present invention. Here, the recording area is divided into four segments. The hard disk recording area covers the area from an outermost circumferential track (track #0) to an innermost circumferential track (track #n). The hard disk recording area is divided into video file areas #1 and #2 110A and 110B, a control information area 120, a circular buffer area 130 for time-delayed watching, and a general file area 140 to thereby enable simultaneous time-delayed watching and recording/reproducing of a broadcast program with efficiency.

The circular buffer area 130 is used to record a broadcast signal which is being

broadcast and reproduce a previously recorded broadcast signal in real time. The circular buffer area 130 can be positioned anywhere in the hard disk recording area, preferably includes tracks at both sides of a center track (2/n) to minimize a search time of a head for time-delayed watching and recording/reproducing a specific channel broadcast signal at the same time.

The video file area #1 and #2 110A and 110B, arranged respectively in outer circumferential tracks and inner circumferential tracks, are used to record a broadcast program at a reserved time. In the video file areas, recorded video streams are arranged uncontinuously in logical files according to a recorded time as shown in FIG. 2.

The general file area 140 is also managed in the non-continuous arranging method to store information other than continuous information like video streams.

The control information area 120 stores information related with each video file such as title and time information and positions of blocks in each file.

FIG. 6 illustrates video streams recorded and stored in the hard disk recording area divided according to the embodiment of the present invention. Here, four video stream blocks are arranged in their respective areas. FIG. 7 illustrates a procedure of processing each stream assigned as shown in FIG. 6 in a C-LOOK algorithm.

In FIG. 6, video stream #1 220 is being recorded in the circular buffer area 130 for time-delayed watching. Video stream #2 210 is already recorded for time-delayed watching. Video stream #3 230 is being recorded in video file area #2 110B and has nothing to do with a program currently being broadcast Video stream #4 is already recorded in video file area #1 110A.

If time-delayed watching and reproduction are selected simultaneously, video streams are read or recorded in an ascending track number order in the C-LOOK algorithm. In this case, a video stream I/O processing order of the HDD is 4, 2, 1 and 3. Thus, video streams #1 and #3 220 and 230 are input to the dual port RAM 32 in T_{i-1} and recorded in assigned recording areas of an HDD 34. Meanwhile, video streams #2 and #4 210 and 200 are read from the hard disk recording area in T_i and output to the video recovery unit 50 in T_{i+1}. On the assumption that video streams are continuously reproduced without delay, a video stream should be read from the recording area in each period so that it can be reproduced in the next period. For recording, a video stream should be generated in the period previous to a recording period.

As described above, arrangement of the circular buffer area 130 in the center of the hard disk recording area can minimizes an average head moving time, that is, an average search time, as compared to an otherwise case.

FIG. 8 is a simplified view of the hard disk area according to the embodiment of the present invention. In FIG. 8, tracks where two video stream blocks are recorded are spaced from n by I and j, respectively. If a circular buffer area is positioned at n, I tracks should be searched to process a video stream in the circular buffer area and other two video stream blocks in the C-LOOK algorithm. On the other hand, if the circular buffer area is positioned at track #0, (i+n) tracks, an n-increased distance should be searched. In this context, the present invention can reduce a head moving time since time-delayed watching can be implemented simultaneously with recording/reproduction.

[EFFECTS OF THE INVENTION]

In accordance with the present invention as described above, a recording area of a recording medium is divided into a circular buffer area and a noncontinuous file area in a broadcast receiving system capable of simultaneous time-delayed watching and recording/reproduction of a broadcast program. Hence, the recording area in a limited space is automatically reused and video streams are formed in logical video files. In addition, recorded video files can be selectively deleted, a head search time is reduced, and a data access rate is increased.

[PATENT CLAIMS]

1. A method of arranging divided recording area segments of a recording medium in a broadcast receiving system having a random access storage device, comprising the steps of:

disposing a circular buffer area in a first predetermined position of the recording medium, for recording a first broadcast signal in real time while reproducing a previously recorded first broadcast signal;

disposing a video file area in a second predetermined position of the recording medium, for recording a second broadcast signal in a logical file at a predetermined time; and

disposing a control information area in a third predetermined position of the recording medium, for recording information about recorded files.

2. The method of claim 1, wherein the video file area is divided into a plurality of segments and the segments are individually managed.

3. The method of claim 1, wherein the circular buffer area and video file area include blocks of fixed sizes.

4. The method of claim 1 or 2, wherein video file blocks are uncontinuously arranged in the video file area.

5. The method of any of claims 1, 2, and 3, further comprising the step of disposing a general file area in a predetermined fourth position of the recording medium, for managing files of information other than continuous data like video information.

6. A method of arranging divided recording area segments of a recording medium in a broadcast receiving system having a hard disk drive, comprising the steps of:

disposing a circular buffer area at the center of the hard disk drive, for recording a first broadcast signal in real time while reproducing a previously recorded first broadcast signal;

disposing a first video file area and a second video file area respectively in an outer circumferential portion and an inner circumferential portion of a hard disk drive recording surface, for recording a second broadcast signal in a logical file at a predetermined time;

disposing a general file area at a boundary of the circular buffer area, for managing files of information other than continuous data like video information; and

disposing a control information area between the circular buffer area and the video file area, for recording information about recorded files.

7. The method of claim 6, wherein the circular buffer area is symmetrical with respect to a center track of the hard disk drive recording surface.

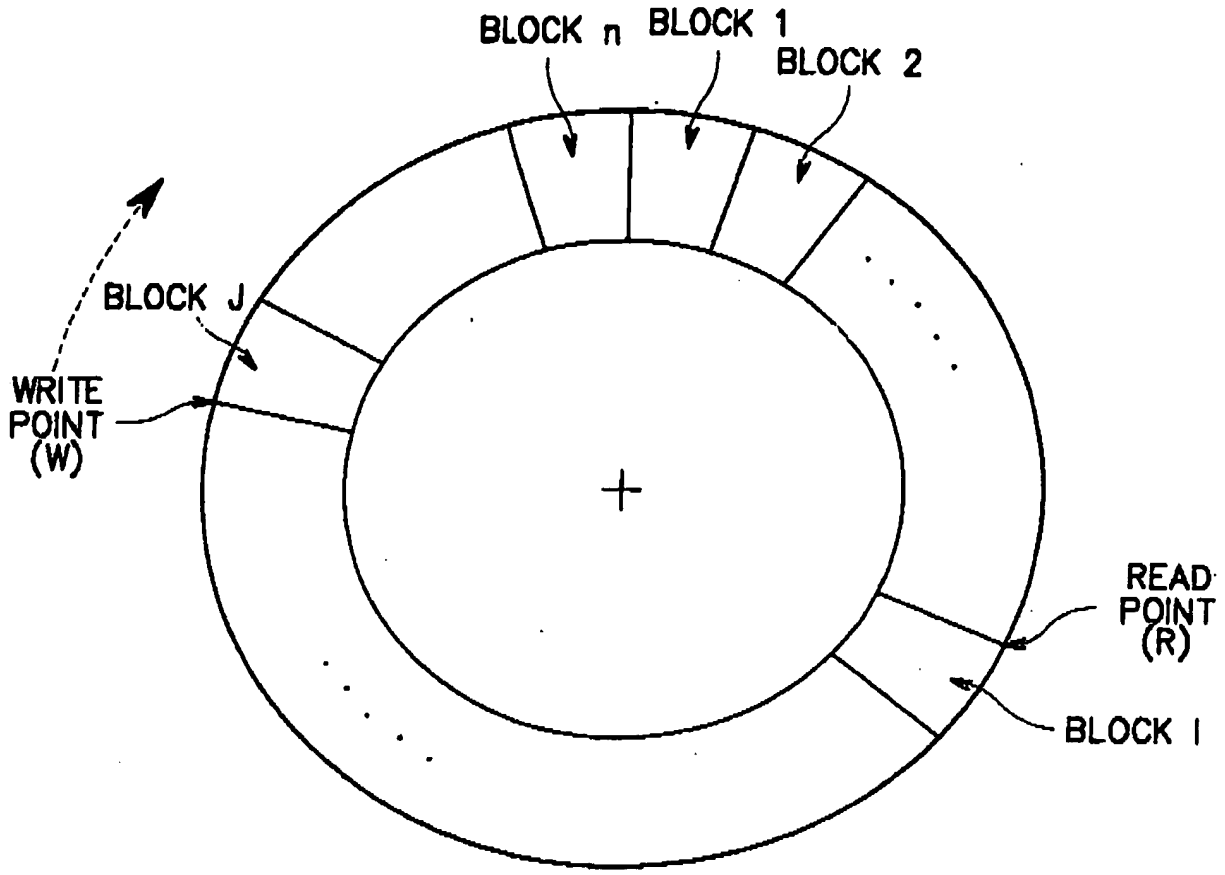


FIG. 1

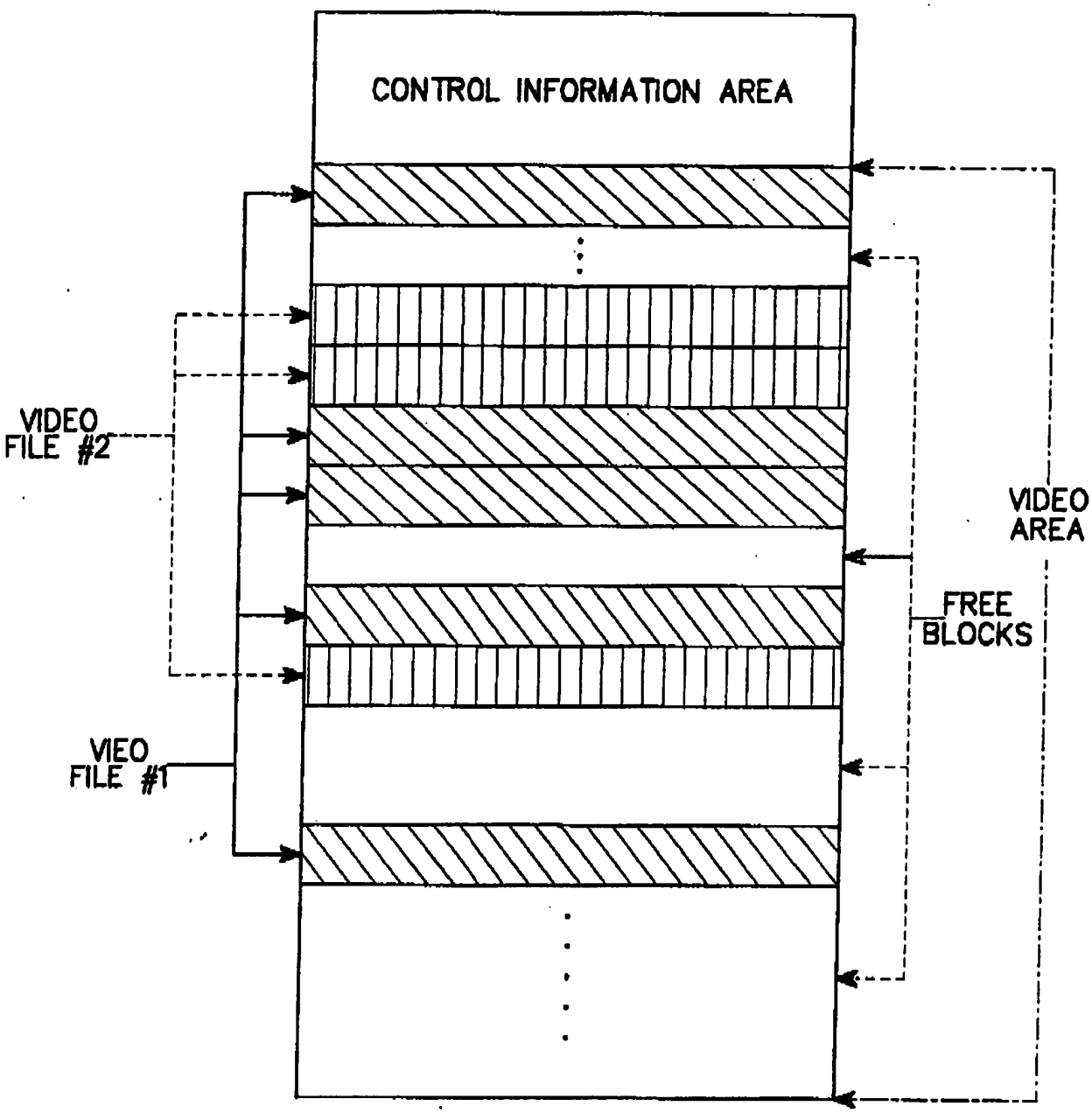


FIG. 2

FIG. 3

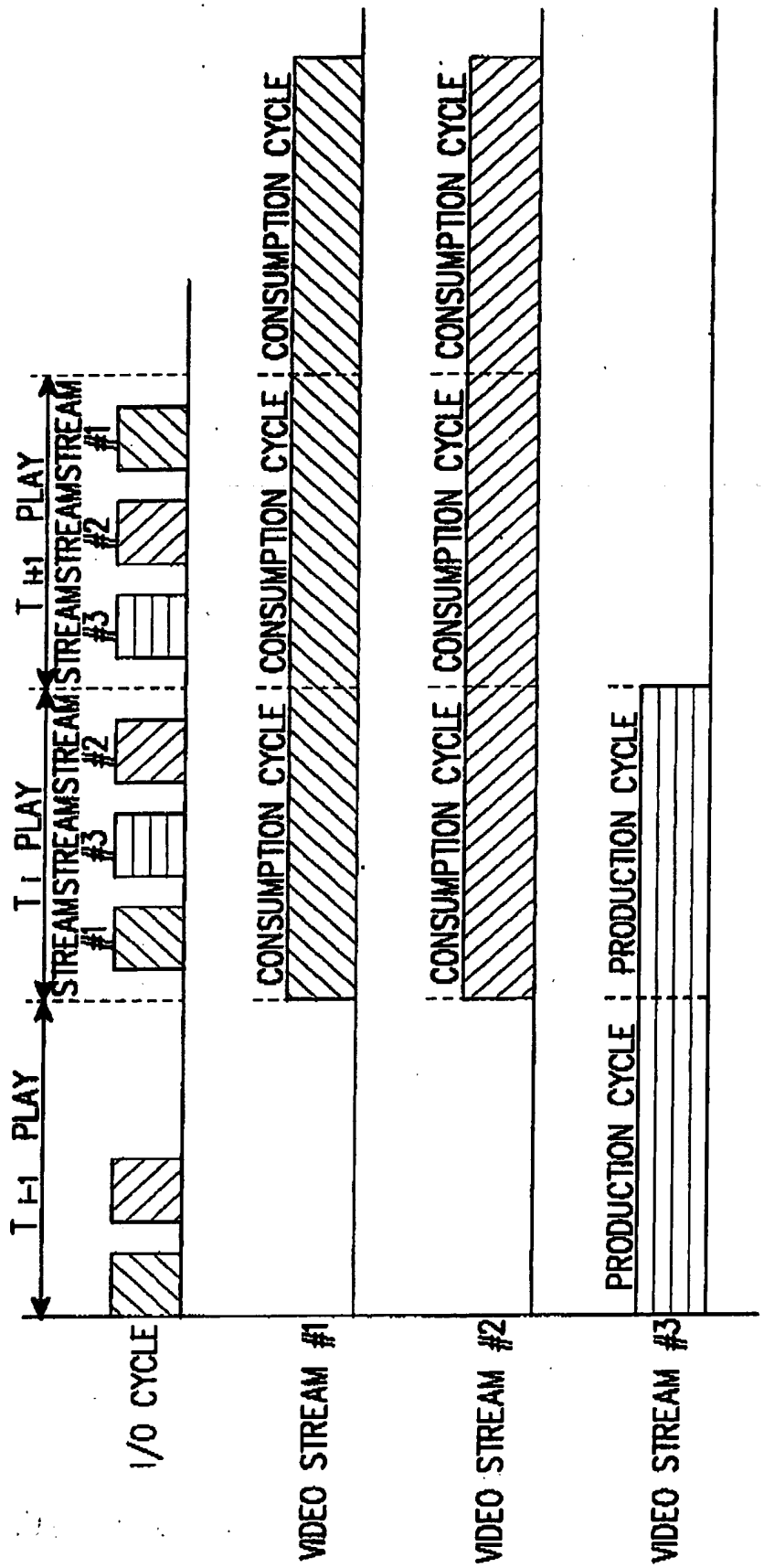
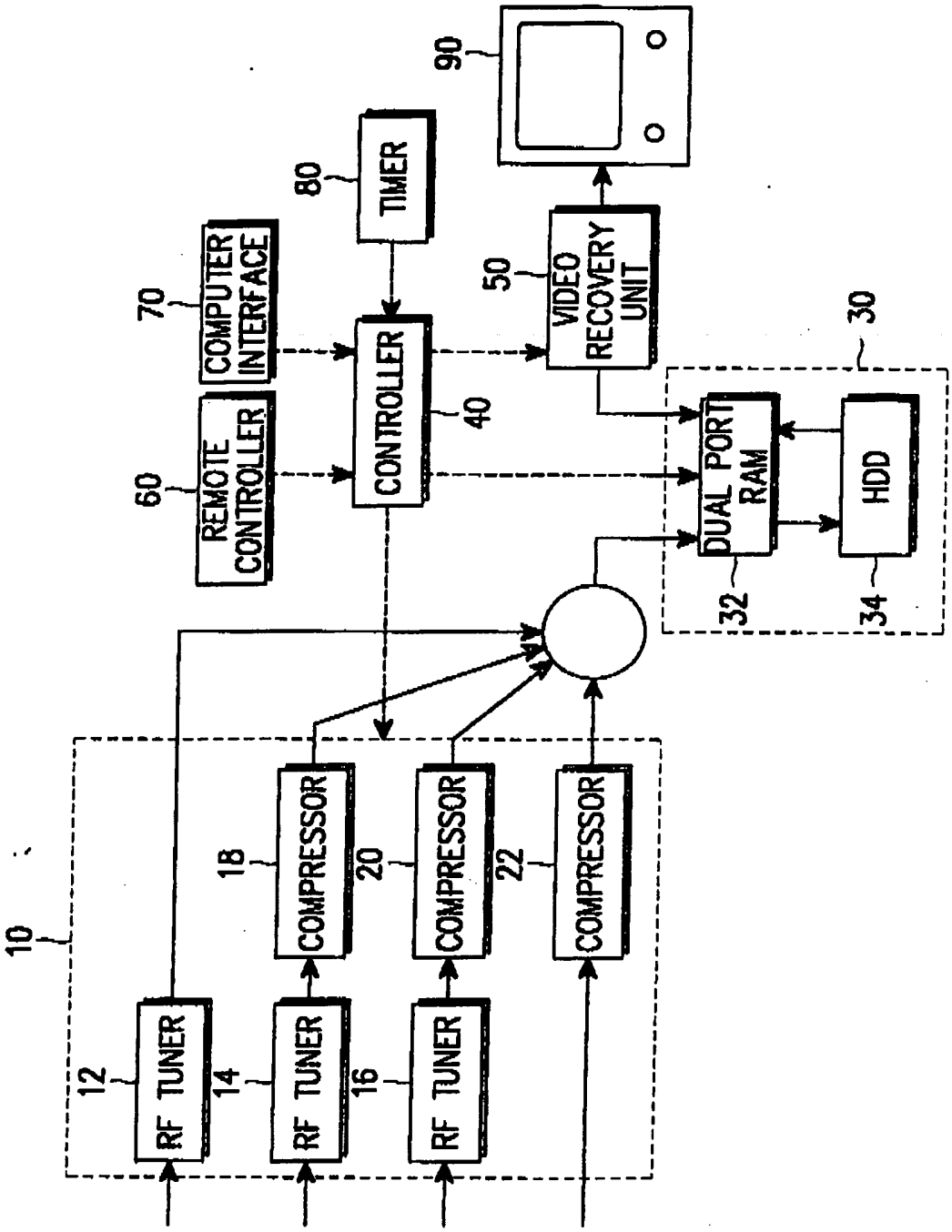


FIG. 4



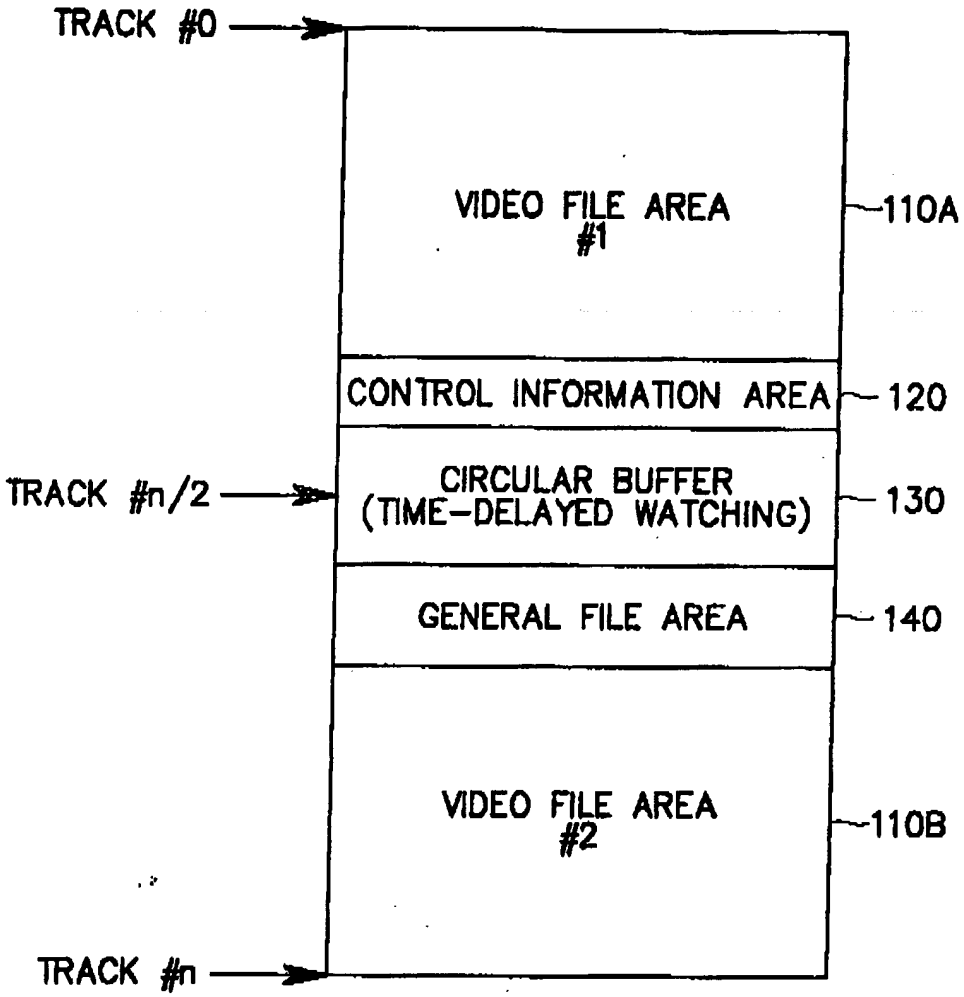


FIG. 5

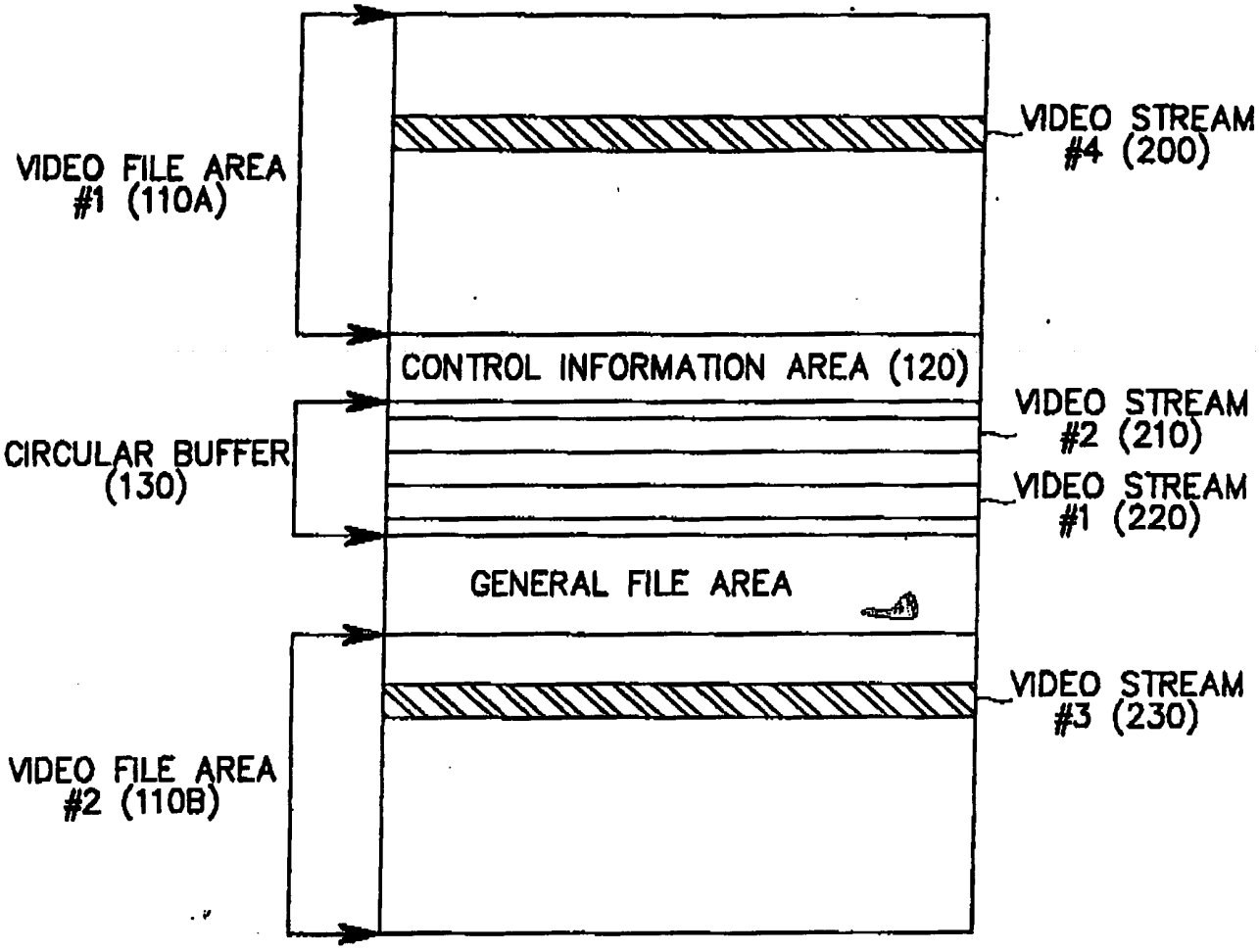
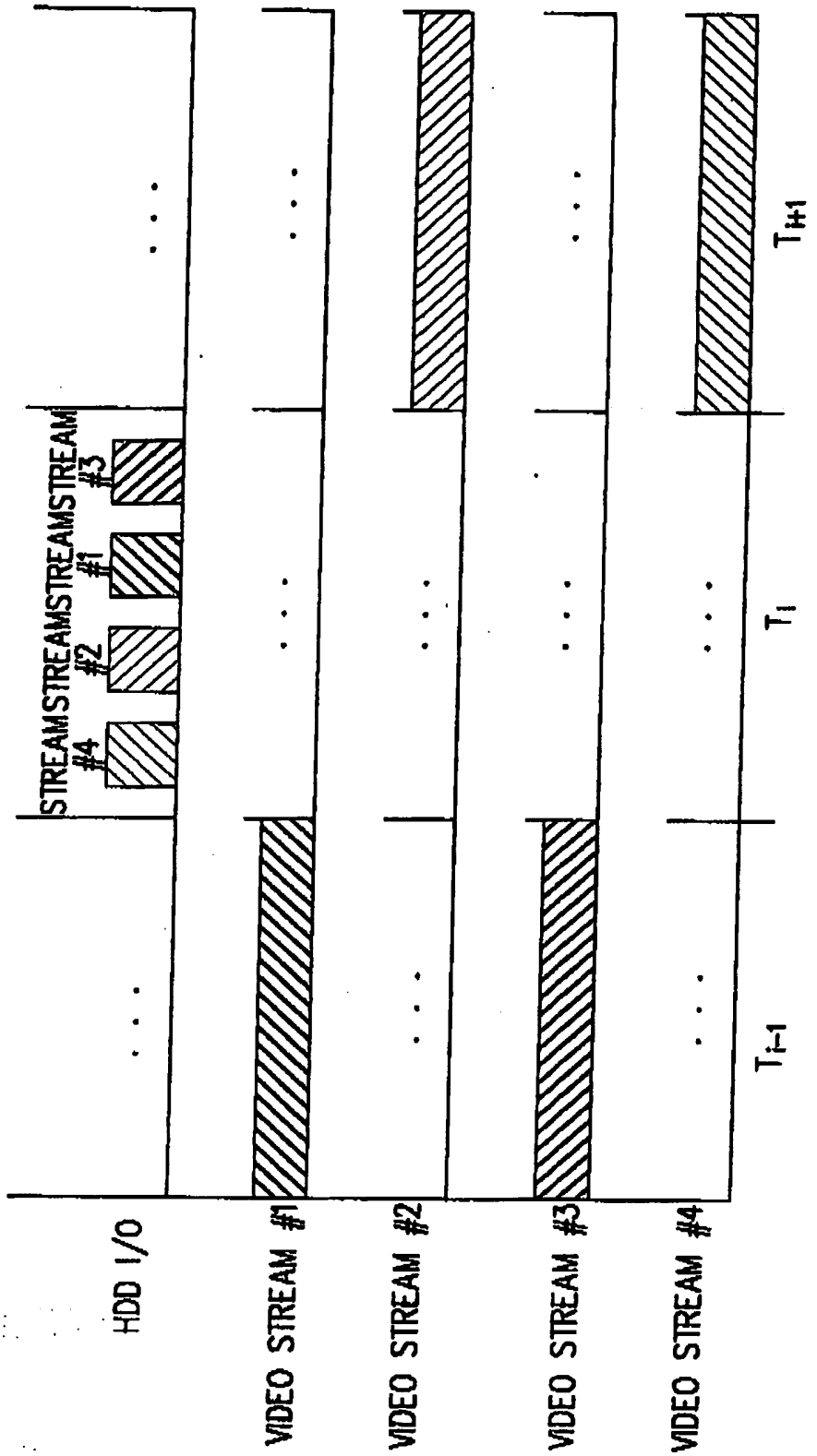


FIG. 6

FIG. 7



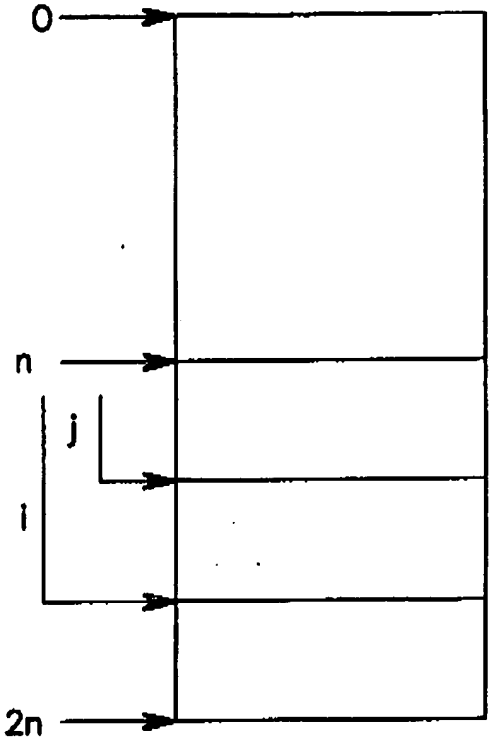


FIG. 8